A METHOD OF PRODUCING A WORKPIECE HAVING AT LEAST ONE BEARING EYE

1. Field of the Invention

The present invention relates to a method of producing a workpiece having at least one bearing eye, the bearing eye being coated with an anti-friction coating made of an alloy of a harder alloy component and a softer alloy component.

2. Description of the Prior Art

Friction bearings subjected to high dynamic loads, for connecting rods of internal combustion engines, for example, are generally made of bearing shells which are received by a divided bearing seat of the workpiece. In order to avoid the disadvantages in regard to the overall size and therefore the weight, as well as the production cost, connected with providing separate bearing shells, it has already been suggested that the bearing eye provided in the workpiece be coated directly with an anti-friction material (European Patent Application 0 635 104 B1). For this purpose, the workpiece may be coated with the anti-friction coating through a thermal spray method, before the anti-friction coating applied to the bearing eye surface is divided together with the workpiece or, if the workpiece is already divided, is itself divided corresponding to the workpiece by a fracture separation. As an additional advantage of this direct coating of the bearing eye, it was emphasized that the bearing eye surface to be coated must no longer be reprocessed for a precise fit, because imprecisions are compensated for by applying the anti-friction coating and it is therefore no longer necessary to appropriately process the anti-friction coating

itself precisely. However, the compensation of imprecisions of the bearing eye requires sufficiently thick anti-friction coatings, which thermal spray methods are particularly suitable for applying. Such thermal spray methods have the disadvantage, however, that the adhesion between the anti-friction coating sprayed on and the bearing eye surface is hardly sufficient for high load requirements without something further. In addition, due to the compensation of imprecisions, after the anti-friction coating has been processed for a precise fit, a non-uniform thickness of the anti-friction coating, whose distribution is unpredictable, must be expected, which, due to the fatigue strength, which is reduced with the thickness of the anti-friction coating, may lead to a localized overload of the anti-friction coating, for example, if anti-friction coating zones, whose position may not be influenced, occur in a high load bearing region.

SUMMARY OF THE INVENTION

The present invention is therefore based on the object of implementing a method of producing a workpiece having at least one bearing eye of the type initially described in such a way that, with a comparatively low production cost, a high dynamic bearing load capacity may be ensured without impairing the service life.

This object is achieved according to the present invention in that the bearing eye is processed for a precise fit to a circular cylinder before the anti-friction coating is applied to the processed bearing eye surface in a thickness corresponding to the final dimensions, the proportion of the softer alloy component in the deposited alloy being increased with increasing coating thickness.

Since, as a consequence of these measures, a precisely fit, circular cylindrical bearing eye surface may be assumed, the final dimension of the running surface formed by the anti-friction coating may be ensured using a thin-layered application of the anti-friction coating without reprocessing of the anti-friction coating, with the advantage that the anti-friction coating has a constructively predetermined thickness

gradient, which represents an essential requirement for a high service life of friction bearings subjected to high dynamic loads, particularly since comparatively thin anti-friction coatings having a thickness of, for example, 20 to 40 μm are possible within narrow tolerance ranges, if no compensation of imprecisions via the anti-friction coating thickness is required. A further requirement for a high dynamic load capacity of such a friction bearing may be seen in the load capacity of the anti-friction coating itself, taking into consideration the running-in conditions, which require a comparatively soft running coating. In order to be able to meet these partially contradictory requirements, the anti-friction coating, which is typically made of an alloy of harder and softer alloy components, is deposited on the bearing eye surface in such a way that with increasing coating thickness, the proportion of the softer alloy component in the deposited alloy is increased, so that the hardness of the anti-friction coating increases from the running surface toward the bearing eye surface. This means that in spite of good running-in conditions, a sufficient support effect to meet high dynamic loads of the friction bearing may also be applied via the anti-friction coating.

Such anti-friction coatings may be applied physically in vacuum with the necessary precision due to the restricted coating thickness. The coating outlay may be simplified in relation to this application method by a galvanic deposition of the anti-friction coating on the bearing eye surface, however. The strength of the electrical field used for the depositing procedure merely has to be changed during the galvanic deposition procedure as a function of the desired increase of the proportion of the softer alloy component. This means, for example, for an anti-friction coating based on a copper-lead alloy, that the current density must be increased during the depositing procedure from an initial 3 A/dm^2 to 10 A/dm^2, in order to elevate the proportion of lead in the deposited coating using the higher current density. The hardness gradient over the thickness of the anti-friction coating thus achieved may be controlled in accordance with the particular requirements via the current density.

During coating of a workpiece having a divided bearing eye, the bearing eye surface is processed for a precise fit after assembly of the divided bearing eye and then galvanically coated with the anti-friction coating, before the anti-friction coating is divided in accordance with the division of the bearing eye through a fracture separation. Since, after the assembly of the divided bearing eye, the processing of the bearing eye for a precise fit is performed in order to provide the requirements for a tailored coating which ensures the final dimensions without reprocessing, it must merely be ensured, after the thin-layered application of the anti-friction coating, that the anti-friction coating applied is divided corresponding to the division of the bearing eye, which is advantageously performed through a fracture separation. The comparatively low coating thickness and the good adhesion of the galvanically deposited anti-friction coating on the bearing eye surface represent advantageous conditions for a fracture separation without problems.